The relationship between consumption, income and wealth in Hong Kong

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Abstract

This paper sets out to estimate a consumption function for Hong Kong along the lines of the standard Life-Cycle-Permanent Income Hypothesis Model. This is not a straightforward exercise given the lack of official estimates of household sector income and wealth holdings in Hong Kong. The paper reports the results of empirical tests between alternative proxies for aggregate labour income which are derived from official estimates of average pay and employment, and employs a new series developed by the Hong Kong Monetary Authority for private sector housing wealth. We find a stable relationship between consumption, labour income and wealth in Hong Kong with plausible long run estimates of the implied marginal propensity to consume out of income and wealth. In particular, the marginal propensity to consume out of housing wealth is estimated to be lower than in other industrialised economies which is consistent with a relatively uneven distribution of wealth in Hong Kong. Arithmetically, the decline in housing wealth in Hong Kong since 1997 can more than account for the weakness of consumption since then.

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Introduction

This paper investigates the relationship between consumption, income, wealth and credit in Hong Kong. This is not a straightforward exercise because of the lack of official estimates of household sector income and wealth holdings. In order to estimate a consumption function, we first of all need to construct proxies for aggregate labour income based on official data on average earnings and employment. We also extend previous empirical work on consumption by employing more comprehensive measures of household sector wealth. For housing wealth we exploit a new series recently developed by the HKMA staff, while for financial wealth we attempt to take account of non-equity wealth as well as equity wealth.

Our aim is to address an important policy issue, concerning the role of falling property prices in explaining the weakness of consumption growth in recent years. Since 1997, average house prices in Hong Kong have fallen by almost 60% and at the same time consumption has been unduly weak. We do not address the question of whether house prices have now reached some kind of equilibrium or fair value, which is the subject of other research[1], but it is interesting to ask whether it is possible to quantify the role played by housing wealth in the downturn given the other negative influences on consumers' spending.

The paper is organised in four sections. Section 1 briefly recaps consumption theory and describes our empirical approach. Section 2 looks at the data issues and describes the proxies used for labour income, housing and financial wealth before going on to examine recent developments in these variables. Section 3 reports our empirical results from estimating a consumption function along the lines of the Life-Cycle-Permanent Income Hypothesis – a standard approach in macro models around the World. It draws out the implied marginal propensities to consume out of income and wealth. Section 4 concludes.

[1] See Peng, W., "What drives property prices in Hong Kong" HKMA Research Paper.

I Theory

A standard approach to modelling consumption assumes that consumers aim to maximise the present value of the sum of utilities of consumption in each future period subject to an intertemporal budget constraint which states that the difference between labour income and consumption is accumulated assets.

Maximise $E_0\left[\sum_{t=0}^{T}(1+\delta)^{-t}U(C_t)\right]$ subject to $W_{t+1} = (1+r_t)(W_t - y_t - c_t)$

where U'(.) is the derivative of a concave one-period utility function, C is consumption, r is the real interest rate, δ is the subjective rate of time preference, W_{t+1} is end-period net housing and financial wealth, y_t is labour income, and r_t is the real interest rate.

In general, there are two approaches to solving this optimisation problem. The first generates an Euler equation or first order condition for the optimal consumption path of a consumer who can borrow and lend at the risk free rate. At the optimum, an individual should be unable to increase her expected lifetime utility by reducing consumption by one unit and increasing her assets, and consuming the extra gross returns the next period:

$$U'(C_{t-1}) = E_{t-1}\{(1+r_t / 1+\delta)\, U'(C_t)\} \quad (1)$$

Under certain assumptions, namely that preferences are quadratic and the real interest rate is constant and equal to the subjective rate of time preference, the growth of consumption follows a random walk (Hall (1978)):

$$\Delta Ct = \alpha + \varepsilon t \quad (2)$$

where εt is the revision between time t-1 and t in individuals' assessment of their permanent income, which should be, if agents are rational, orthogonal to any known information at time t-1. Empirically, the model predicts lagged variables to be statistically insignificant in forecasting current consumption growth.[2]

A second approach allows aggregate desired consumption to depend upon the anticipated value of lifetime resources, which equals current and anticipated future labour income and current financial and housing assets. Under a constant real interest rate assumption, this implies a long run relationship of the form of equation (3):

[2] Empirical failures of the Euler equation approach are well documented. Hall (1978) himself found that changes in stock prices were a significant predictor of consumption growth.

$$C_t^{\text{planned}} = \alpha_0 + \alpha_1 Y_t + \alpha_2 \sum_{k=1}^{n} Y_{t+k}^{e} + \alpha_2 W_t \qquad (3)$$

This kind of consumption function can be derived from the well-known Life-Cycle-Permanent Income Hypothesis (LCPIH) model of saving by Ando and Modigliani (1963). In their model, consumers maximise utility from consumption subject to lifetime resources. Current consumption can be expressed as a function of lifetime resources and the rate of return on capital with parameters depending upon age. The individual consumption functions are then aggregated to derive an aggregate consumption function that is linear in income and wealth.

There are several issues that need to be addressed before estimating equation (3). The first is that expected future income which influences planned spending is unobserved. There are different ways around this problem. One approach is to assume that log labour income follows a random walk with drift process so that its growth rate fluctuates around a constant trend. This allows us to derive an expression for the present discounted value of future income that is linear in current income, along the lines of equation (4) [3]:

$$C_t^{\text{planned}} = \gamma_0 + \gamma_1 Y_t + \gamma_2 W_t \qquad (4)$$

Second, actual consumption in any given period may not equal planned spending due to the existence of adjustment costs, habit persistence or the existence of liquidity-constrained consumers. To allow for adjustment lags in our empirical work, we estimate an error correction dynamic specification along the lines of the DHSY (1978) model estimated on UK data:

$$\Delta C_t = \delta_0 - \delta_1 (C_{t-1} - \gamma_1 Y_{t-1} - \gamma_2 W_{t-1}) + \sum_{i=0}^{m} \theta_i \Delta Y_{t-i} + \sum_{j=0}^{n} \tau_j \Delta W_{t-j} + U_t \qquad (5)$$

Third, the consumption function derived above is assumed to be linear in the levels of the variables so that the coefficients measure the effect on consumption of a unit increase in income and wealth. However, many authors have found aggregate time series data on consumption, income and wealth to be closer to being linear in logs of variables rather than levels. In that case, the estimated coefficients are elasticities and the implied level responses need to be backed out using the consumption to income and consumption to wealth ratios evaluated at their sample means.

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[3] Another approach is to assume that expected future labour income is proportional to expected current labour income $Y^{e}_{t+k} = \beta\, Y^{e}_{t}$. Current income is unknown so that planned consumption depends on its anticipated value at t-1, so that $Y_t = Y^{e}_{t} + \varepsilon_t$. This allows replacement of the unobserved future income variable by actual current income. The dynamic equation (5) then has a moving average error term which is correlated with current period income and wealth. OLS estimates of the coefficients are likely to be biased, a problem which can be overcome by using Instrumental Variables estimation techniques. See Mehra (2001).

Fourth, Gali (1990) shows that an aggregate consumption function along the lines of equation (4) can be derived from the dynamic optimisating behaviour of consumers with finite horizons and lifetime savings, and establishes the existence of a common upward trend in aggregate consumption, labour income and wealth, so we would expect to find a cointegrating relationship among these variables.

II Data issues

Before turning to estimation, it is first of all necessary to address some important data issues. In particular, the lack of official estimates of household sector income and wealth holdings in Hong Kong poses significant problems in estimating and interpreting the coefficients in a standard consumption function along the lines of equation (5). Existing studies tend to employ GDP as a proxy for household income and house prices and/or stock prices as a proxy for wealth.[4] These find that consumption, GDP and house prices are cointegrated, and that the restriction that the coefficients on GDP and house prices sum to 1 cannot be rejected. It is possible that the latter reflects the high share of consumption in GDP rather than any meaningful behavioural relationship between household resources and consumers' spending. The endogeneity of GDP also limits the usefulness of any estimated relationship for short-term forecasting given the circularity involved in first of all having to forecast GDP - which is largely driven by movements in consumption - before making a forecast for consumption. It is therefore worth asking whether better proxies of income can be constructed, which is the subject of the next section.

Proxying labour income

Official estimates of income for the household sector separately are not published in Hong Kong but simple proxies[5] can be constructed which use published data on the number of people employed and average pay:

Whole Economy Labour Income = Employment * Post-tax Average Pay

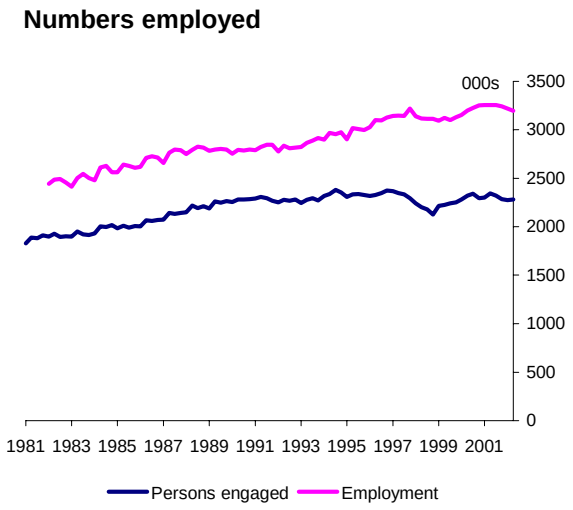
For the number of people employed there is a choice between two series, 'employment' or 'persons engaged'. These measures are based on different surveys, the employment series is based on the General Household Survey (GHS) while estimates of the number of persons engaged come from the Quarterly Survey of Employment and Vacancies. The latter measure has a more narrow coverage and excludes civil servants and the self-employed which together account for about 400,000 workers or 12% of total employment. Chart 1 shows that employment has grown faster than the number of persons engaged since the middle of the 1990s. This could reflect changes in the composition of employment as the economy has slowed, namely a shake-out of employees some of whom may become self-employed which would shrink the number of

[4] See Lai, Kitty., "Consumer credit, household debt service and consumption" HKMA Quarterly Bulletin XX.
[5] These are not complete because they do not include income in kind or the labour income component of self-employment income.

persons, which does not include the self-employed, relative to employment. However, differences in coverage are not the whole story since the number of civil servants and the self-employed are too small in number to explain the gap between the two measures. There are also likely to be sampling errors affecting one or both measures and it is not possible to say which one is more reliable. The choice of which measure to use is therefore as an empirical matter.

For average pay, there is a choice of several measures as well. The published estimates of labour compensation are probably the most comprehensive measure of whole economy labour income because these include benefits-in-kind and employers' social security payments as well as average pay. However, only annual estimates are published so there is a problem of how to interpolate these to derive the quarterly estimates needed for estimation work. There are quarterly estimates of average payrolls but these relate to persons engaged only which excludes certain components of employment while the wage and salary indices have even more limited coverage of manual workers only.

Chart 1



For estimation, we test between three alternative proxies of aggregate labour income, shown in Chart 2[6]:

- Average payroll per person engaged grossed up by total employment on the assumption that average labour income for civil servants and the self employed is broadly the same as for employed persons (LY1);

- Average payroll per person engaged grossed up by the number of persons engaged (LY2);

[6] It should be noted that the above estimates all imply a level of labour income which is below the level of consumption. That does not, however, imply a persistently negative household sector savings ratio since household income includes benefits and other non-labour income. By way of comparison, the ratio of labour income to consumption in Hong Kong using LY1 was 0.82 (2002 Q2) - similar to that for the UK of 0.76 (2001).

- Annual estimates of total labour compensation in the economy which are interpolated by average payrolls multiplied by employment to derive quarterly estimates (LY3).

All of the above measures are defined gross of salary taxes reflecting the lack of quarterly data on salary taxes prior to 1991. However, the distinction between gross and net pay is less important in Hong Kong than in other industrialised economies because of its relatively low rate of income tax and high thresholds which produce a low effective rate of income tax (see Chart 3). In fact, we find that excluding salary taxes does not affect the coefficient estimates in a significant way for the relevant sample period 1991–2002, so we ignore tax data in favour of a longer estimation period.

Chart 2

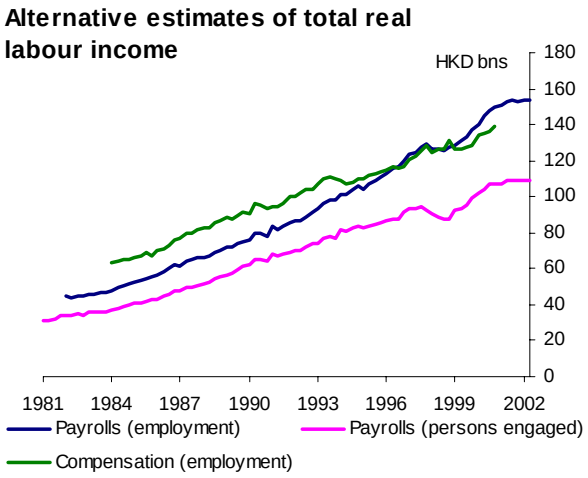
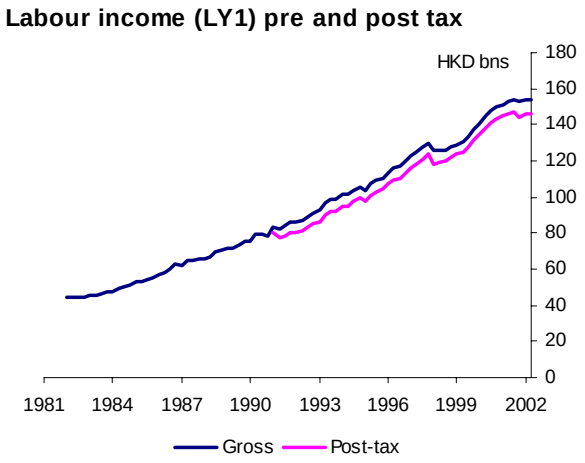


Chart 3



Proxying household wealth

For household sector housing wealth, we use a new series recently developed by HKMA staff built up from figures of the privately owned housing stock by size and by region (Central, Kowloon, and NT):

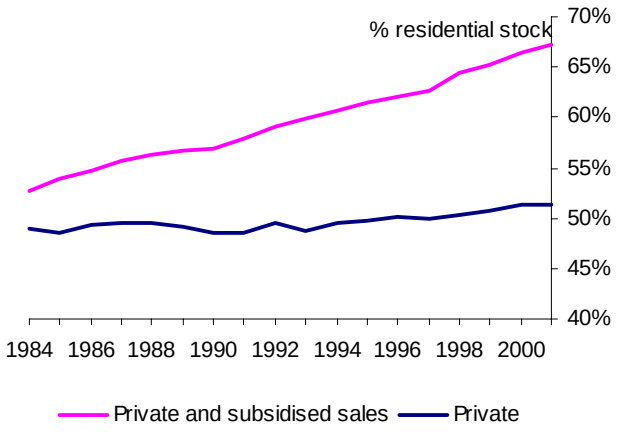
Gross housing assets = Number of privately-owned residential units *
Average price per sq ft * Average size of property

There are a couple of measurement issues to consider here. The first is that the HKMA estimates ignore private ownership of publicly-built flats which have been bought from the government at a discount. This is for consistency with the house price index which excludes subsidised sales on the grounds that are generally not representative of market prices. (An exception is made for

secondary sales of publicly-built flats sold into the 'open market' where the initial discount needs to be repaid to the government. However, these are thought to be small in number.) This exclusion will tend to bias downwards the estimates of household sector housing wealth, since sales of publicly-built flats have been the main driver of growth in home ownership over the last 15 years (Chart 4). Consequently, this will introduce a bias in the estimated elasticity of consumption with respect to housing wealth, although we think that the effect will be limited by the fact that ownership of publicly-built flats accounts for a minority share of household sector housing wealth because these properties tend to be smaller in size than privately-built properties and are located in relatively cheap areas.

Chart 4

Private ownership of residential stock



There are no official estimates of household sector financial wealth, so we need to proxy this. This is complicated by the lack of a split between household and corporate sector for bank deposits and equity holdings, and the inability to distinguish between residents' and foreigners' holdings across the stock of financial assets more generally (there are some balance of payments estimates on the net stock of foreign assets and liabilities but these are annual and only go back to 1997). Despite these measurement problems, the estimated elasticity on financial wealth may still provide a reasonable guide to the effect of changes in household sector financial wealth on consumption. In this regard, it is encouraging that household sector holdings of risky financial assets appear to have been reasonably stable over recent years. A survey of retail investors conducted every three years by the Securities and Futures Commission Survey (SFC) shows that around one-fifth of respondents either have traded or plan to trade in shares, and that this has remained broadly the same since 1996 (Table 1). Note also that, in the same survey, less than 1% of individuals report any trading in bonds so we can effectively ignore these financial assets.

Table 1: Securities and Futures Commission Survey of retail investors
% of individuals trading stocks and other risky assets (shown in brackets) [1]

	1996	1999	2001
% of individuals trading in last 3 years	20%	18% (2%)	23% (3%)
% of individuals trading in last 12 months	N/a	12% (2%)	18% (3%)
% of individuals planning to trade	16%[2]	15% (4%)[3]	16% (3%)[2]

(1) Includes derivatives, funds, leveraged forex contracts & bonds; (2) Next six months; (3) Next twelve months

Source: Securities and Futures Commission Survey of retail investors 1996, 1999 and 2001.

Recent developments in consumption, income and wealth

Now that we have some, albeit simple, proxies for household income and wealth, it is worth looking at a few plots of the relationship between consumption, income and wealth before moving on to discuss our estimation results.

The growth rate of real consumers' spending has been exceptionally weak since the mid 1990s, growing at an average annual rate of 1.7% compared with 6.2% historically (Chart 5). This reflects a sequence of negative shocks, namely a fall in asset prices in the mid 1990s; fall-out from the crisis in East Asian economies in 1997 and 1998, which caused consumption growth in Hong Kong to turn sharply negative and, in more recent quarters, the post-2000 collapse in global stock markets. The weakness has been pretty much across the board with durables, non-durables and services all growing below their long term average (Chart 6), though the weakness in durable goods spending - which is usually much more cyclical - has been especially marked. In levels terms, real consumption had only just about returned to its pre-Asian crisis heights by 2002 Q2 (Chart 7).

Chart 5

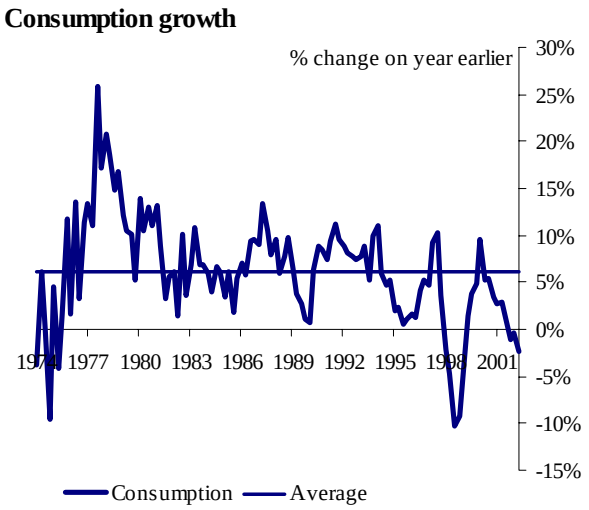


Chart 6

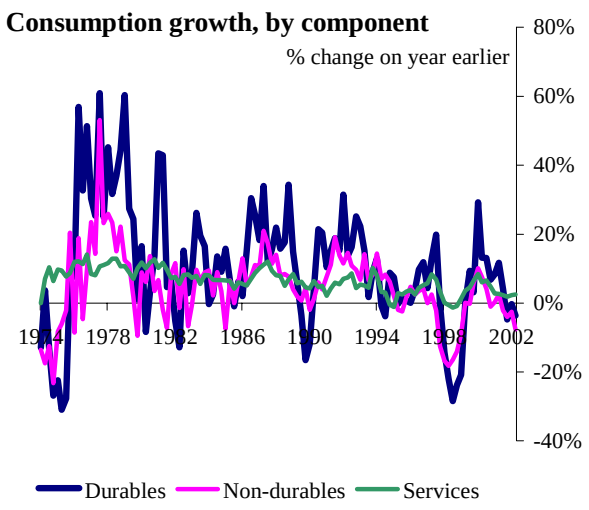
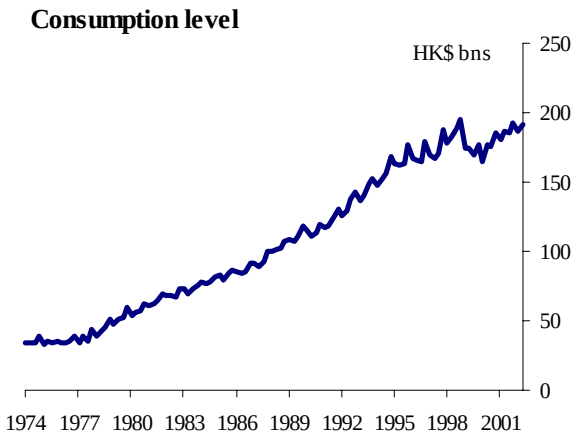


Chart 7



The cycles in consumption growth have been mirrored by similar fluctuations in labour income which shows three dips over the last seven years (Chart 8). The growth rate of real labour income per person engaged declined especially sharply in the wake of the Asian crisis as the growth of average payrolls declined and employment fell. It then recovered as employment growth rallied only to weaken again at the start of 2000. The fall in nominal payrolls has been more marked since 1997, turning negative in 1999 and again at the beginning of 2002, as deflation has taken a hold (Chart 9).

Chart 8

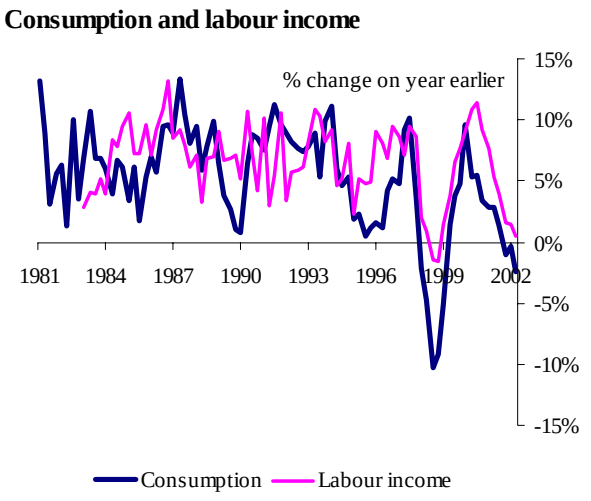
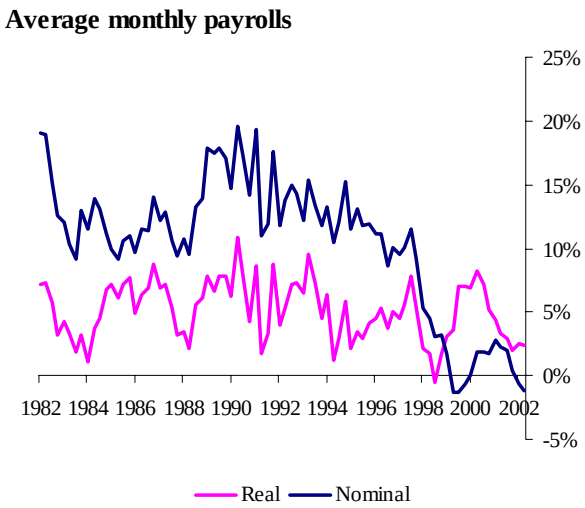


Chart 9



Wealth & real interest rates

Charts 10 and 11 plot the annual change in real consumption growth against changes in real house and stock prices. Average house prices have been volatile in Hong Kong and especially over the last decade. There have been three cyclical swings, in 1991-92, 1993-95, and 1996-97, with real house prices turning negative in the last two downturns. On the face of it, there appears to be a strong correlation between house price and consumption changes and this is especially the case for the 1997-98 downturn which was associated with sharp falls in consumption growth. The weakness in house prices has persisted over the last five years with house prices falling by over 58% between their peak in 1997 and 2002 Q2.

Equity prices have shown a similar pattern of cyclical swings over the 1990s. But these appear to be more volatile especially over the 1980s, and the less good correlation over that earlier decade could explain the weak explanatory power of stock prices relative to house prices found in previous empirical studies of consumption (e.g. see Lai (2002)).

Chart 10

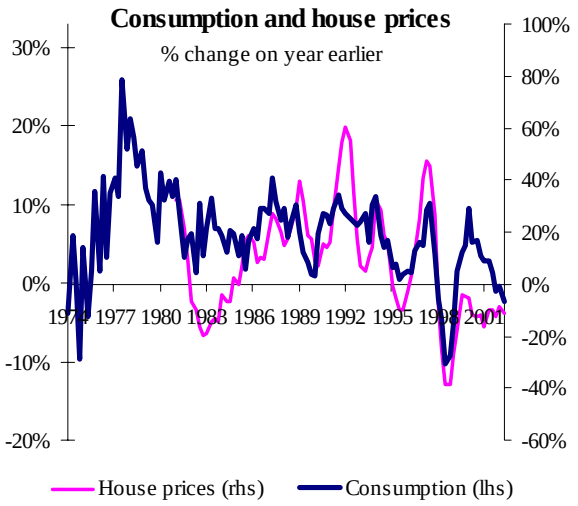
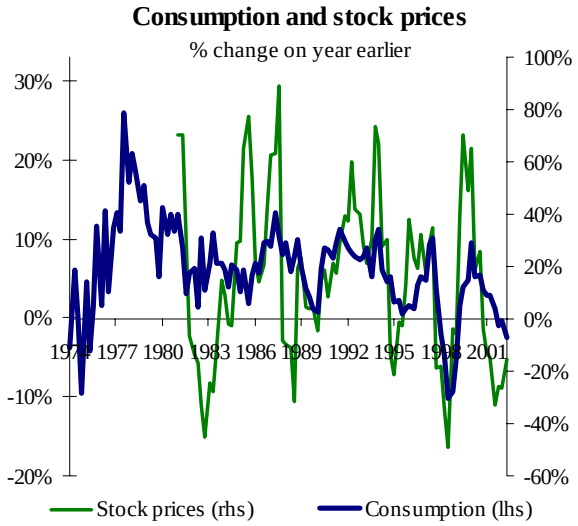


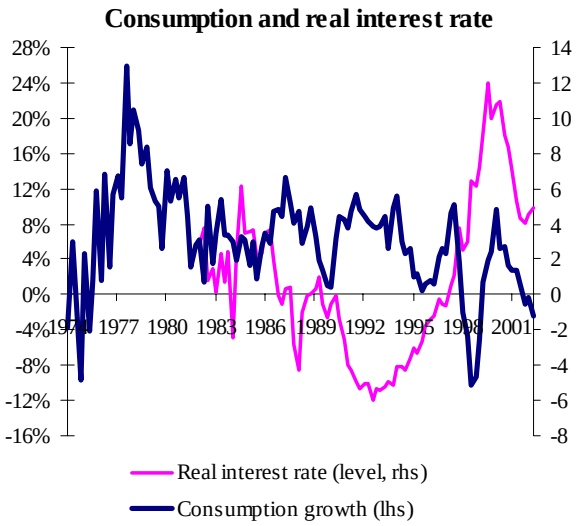
Chart 11



The real interest rate, proxied by the 1-month HIBOR rate minus the (actual) annual rate of consumer price inflation, is shown in Chart 12. It declined between the mid 1980s and early 1990s as the inflation rate accelerated, from around 3% to 10% between 1985 and 1990, and then stayed high as nominal interest rates declined, from over 8% to under 4% between 1990 and 1992. But the most striking observation is the steep run-up in the real interest rate between 1992 and 1998 from –5% to almost 10%. From the mid 1990s onwards, this primarily reflected the deceleration in the annual inflation rate, which turned negative in 1998 and averaged –4% in 1999. The real interest rate peaked at 9.8% in 2000 and, since then, has fallen as nominal

interest rates have been reduced from around 6.5% to under 2% in the two years to 2002 Q2, outweighing the effect of a gradual easing in the annual rate of consumer price deflation.

Chart 12



Long run relationship

Turning to the levels relationships, Chart 13 plots the ratio of consumption to labour income for each of our three alternative measures of labour income. There is a downward drift in the ratio following the Asian crisis: consumption fails to keep pace with the growth of labour income suggesting a rising savings ratio. The trend is similar across all three measures and, therefore, does not seem to be related to the way in which labour income is estimated.

Chart 13

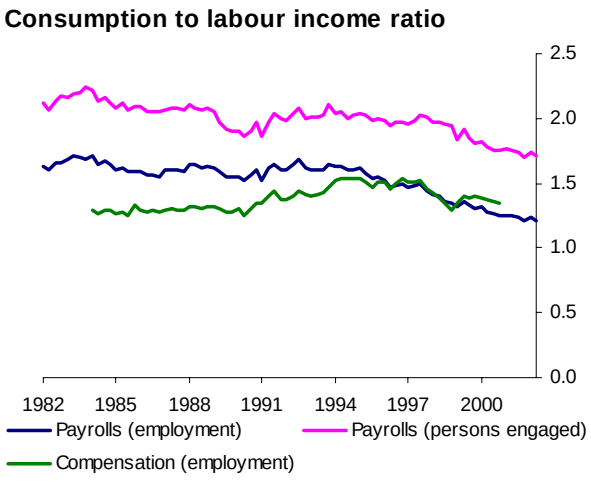
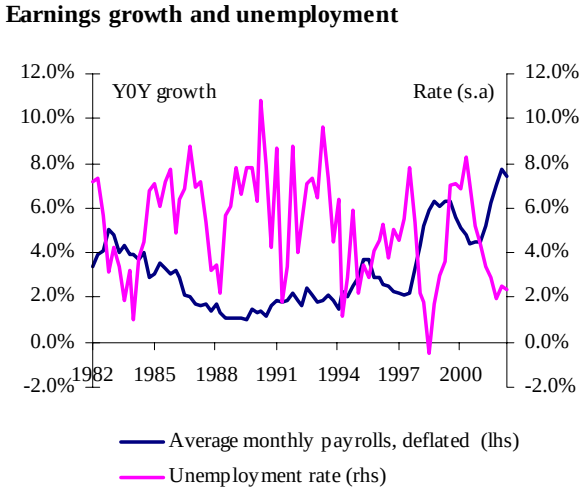


Chart 14



There are two types of explanation for the apparent downward drift in the consumption to labour income ratio. The first is that it reflects measurement error. Consumption may be understated and/or labour income is overstated, or both may be true. For this to be a candidate explanation, the error would need to be steadily increasing over the second half of the 1990s which is plausible for a couple of reasons:

- Following the handover in 1997 and the increase in cross-border shopping flows, it is possible that spending by Hong Kong residents in the Mainland is less reliably captured by existing consumer surveys, and that the error is increasing as the number of day-trippers increase.[7]
- The economic downturn following the Asian crisis and post-2000 fall in global stock markets may have led to weaker labour income than recorded by official estimates. Indeed, surprise is often expressed at the fact that real earnings growth has not fallen more sharply given the increase in unemployment (Chart 14).

Alternatively, there may be good economic reasons that have caused consumers to reduce their propensity to spend out of labour income.

- The most obvious one is the fall in housing wealth post-1997 which has been reinforced by falls in stock market wealth post-2000 to reduce overall net wealth (Chart 15 and 16).

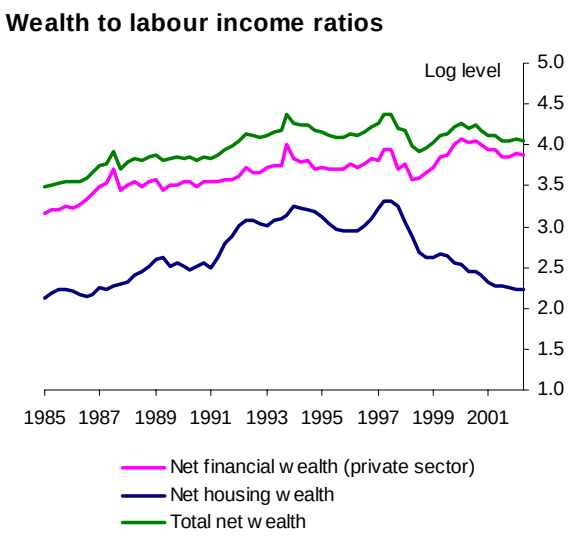
- The rise in real interest rates during the 1990s may have caused some individuals to reduce their current consumption in favour of increasing their savings in order to raise their future spending. This intertemporal substitution of current for future consumption would mainly affect the spending of consumers who are not liquidity constrained.

- In addition, there may be balance sheet effects arising from deflation. Deflation leads to a redistribution from borrowers to savers for those who have assets and liabilities fixed in nominal terms. This may cause aggregate consumption to fall if borrowers have a higher marginal propensity to consume which is plausible. These redistributional effects may be quite significant given the increase in consumer debt ratios over the second half of the 1990s.

[7] Residents' spending abroad has no effect on GDP as a whole since this is counted as imports which are deducted from overall domestic spending. In principle, therefore, any errors should have no effect on GDP.

Chart 15

Chart 16



III Estimation results

This section reports the results from estimating a dynamic consumption function along the lines of equation (5), where consumption depends on income and wealth in the long run and the real interest rate, and changes in income, wealth and unemployment in the short run. All variables except for the real interest rate and the unemployment rate are in logs and deflated by the consumers' expenditure deflator. Finally, where relevant, variables are seasonally adjusted by the Census X-12 method in eviews. As discussed earlier, we would expect to find a cointegrating relationship between the log level of consumption, income and wealth. In fact, because equation (5) contains lagged log levels of consumption, income and wealth (as well as first differences) and these variables have unit roots[8], estimation would not yield consistent estimates unless these variables are cointegrated.

Table 3 summarises the Johansen results on the number of cointegrating vectors based on the trace statistic for each measure of labour income in turn. The sample period is 1985 Q2 – 2000 Q4 because of the limited time series data on stock market capitalisation, which starts in 1985 and feeds into net financial wealth, and on labour compensation, which is one of our labour income series and is only available up to 2000. In all three cases, there appears to be a single cointegrating vector between consumption, income, net housing wealth and (private sector) net financial assets over the period 1985Q4 – 2000Q4.

[8] Annex 1 shows the results of unit root tests. All of the variables appear to be I(1) with the exception of the real interest rate and the log of the unemployment rate which are stationary variables.

Table 3: Johansen cointegration rank test

Variables: Consumption, labour income, net financial wealth and net housing wealth (all variables in real terms and in logs)

Lags interval (in first differences): 1 to 2

Using LY1		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.414424	61.06014	47.21	54.46
At most 1	0.266420	28.41548	29.68	35.65

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Using LY2		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.445700	55.58410	47.21	54.46
At most 1	0.200944	19.59111	29.68	35.65

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Using LY3		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.423333	52.29991	47.21	54.46
At most 1	0.198049	18.72003	29.68	35.65

Trace test indicates 1 cointegrating equation(s) at the 5% level

Trace test indicates no cointegration at the 1% level

Dynamic equation

To estimate the dynamic relationship we use a one step Engle Granger technique where the long run and the dynamics are estimated simultaneously on the assumption that there is a cointegrating relationship between the log of consumption, labour and wealth. We use the same specification, as described above, to test the three alternative measures of labour income.

The results show that the error correction term is highly significant in two out of the three equations with a t-statistic of 4.9 in equation (i) and 4.0 in equation (ii). It is not significant at the 5% level in equation (iii). The level of labour income, wealth and the real interest rate are also significant and correctly signed in equation (i). The coefficients on net financial wealth and the real interest rate are less well determined in equation (ii), with t-statistics of around 1.5, and this is even more so in equation (iii) where many of the levels terms are not significant at the 10% significance level.

Table 4: Dynamic equations

Dependent variable: Quarterly change in log of real consumption

Sample period: 1985Q2 – 2000Q4

	Equation (i) using payrolls * employment (LY1)	Equation (ii) using payrolls * persons engaged (LY2)	Equation (iii) using total compensation to employees (LY3)
Constant	1.65 (4.5)	1.13 (3.39)	0.61 (1.8)
Log change in labour income	0.29 (2.8)	0.15 (1.59)	0.11 (1.0)
Log change in net housing wealth	0.07 (2.6)	0.08 (2.53)	0.09 (2.8)
Log change in net financial wealth	0.05 (2.7)	0.05 (2.3)	0.06 (2.7)
Log change in unemployment rate	-0.26 (-2.5)	-0.03 (-2.8)	-0.03 (-2.2)
Log consumption (-1)	-0.55 (-4.9)	-0.36 (-4.0)	-0.22 (-2.5)
Log labour income (-1)	0.32 (4.2)	0.20 (3.4)	0.08 (1.3)
Log of net housing wealth (-1)	0.039 (2.6)	0.033 (2.1)	0.024 (1.3)
Log of net financial wealth (-1)	0.047 (2.3)	0.032 (1.5)	0.048 (2.1)
Real interest rate (-1)	-0.39 (-4.1)	-0.09 (-1.5)	-0.08 (-1.2)
Long run coefficients:			
Labour income	0.58	0.55	0.36
Housing wealth	0.07	0.09	0.11
Financial wealth	0.08	0.09	0.22
Sum of coefficients	0.73	0.73	0.69
Wald test of equality of wealth coefficients; F-stat (1,53)	0.74	0.96	0.35
Diagnostics:			
R-squared	0.68	0.64	0.57
S. E. Regression (x100)	1.2	1.3	1.4
Breusch-Godfrey LM(4), F-stat	0.80	0.51	0.48
ARCH LM(4), F-stat	0.89	0.52	0.85
Normality	0.39	0.63	0.67
Ramsey reset test, F-stat	0.78	0.69	0.58

All variables are in real terms, in logs (except for real interest rate and unemployment rate) and are seasonally adjusted using eviews Census X-12 method.

Comparing across the three measures of labour income, the equations based on payrolls data, equations (i) and (ii), perform significantly better than that based on compensation, equation (iii), on a number of counts. The residual sum of squares is lower. The coefficient on both the level of labour income and its first order change are of higher significance than in equation (iii). Equation (i) based on LY1 looks especially encouraging – the individual coefficients are better determined and the overall equation has a lower standard error than that based on LY2, equation (ii). The implied marginal propensity to consume out of labour income in this preferred baseline

equation (i) is 0.87[9], that is, at an aggregate level 0.87 cents of every extra dollar of labour income is spent, which is plausible when compared to estimates for other countries, e.g. 0.89 for the UK according to the Bank of England's consumption function[10].

Turning to the wealth coefficients, in general, the long run coefficients on net housing and net financial wealth look reasonable. A Wald test for the restriction that the coefficients on the wealth terms are equal is accepted in all three equations. Housing wealth in these equations is defined net of mortgage debt but it makes little difference to the coefficients if housing wealth is defined gross instead (with mortgage debt included in net financial assets).

The short-term real interest rate is highly significant and correctly (negatively) signed in equation (i). This effect is over and above the wealth effects associated with changes in real interest rates, and is interpreted as picking up intertemporal substitution effects: a rise in the real interest rate, which reduces the price of future consumption, causes individuals to substitute current for future consumption.[11] According to equation (i) a 100 basis point increase in the real interest rates reduces the level of consumption by 0.39%, which is similar to estimates for other countries e.g. the UK estimate of 0.28%.[12] The response is lower in equations (ii) and (iii), but is not significant at the 10% level in either equation.

The change in the log of the unemployment rate is significant and correctly (negatively) signed in all three equations, which is interpreted as picking up precautionary savings motives along the lines suggested by Carroll (1992). A rise in aggregate unemployment raises the probability of job loss at the individual level thereby raising precautionary savings by risk-averse consumers anxious to avoid the disutility associated with a possible sharp fall in their consumption.

Wealth effects

The marginal propensity to consume out of wealth ($\delta C / \delta W$) can be retrieved by dividing the estimated wealth elasticity $\{(\delta C / C) / (\delta W / W)\}$ in the above equations by the average ratio of wealth to consumption (W/C) over the sample period, using:

[9] Gali (1990) shows that , in the presence of finite horizons and life cycle savings the marginal propensity to consume out of labour income will be less than one. It depends among other things on the age structure of the population and the distribution of income and wealth by age group.

[10] See Economic models at the Bank of England, September 2000 update.

[11] This is measured by the 1-month HIBOR minus the annual rate of CPI inflation; results are similar using the 3-month and 12-month HIBOR. We note that this may not be the best conceptual measure to use, others have used proxies for the expected long real rate, where expectations are modelled econometrically. Research by HKMA suggests that such a measure has been less variable than our measure – see "Real interest rates in Hong Kong" HKMA Quarterly Bulletin, August 1999. The issue may be overplayed, however, and the choice between short and longer term rates depends on various factors, among them the term structure of consumer debt - in HK, most mortgages are floating rather than fixed rate and so are heavily influenced by short rates.

[12] See footnote (4).

$$\frac{\delta C / C}{\delta W / W} = \frac{\delta C}{\delta W} * \frac{W}{C}$$ = Marginal Propensity to Consume * Wealth to Consumption Ratio

The estimated elasticity will depend on a combination of factors, not least the overall size of household sector wealth holdings. Even if the overall size of household sector wealth is sizeable, its distribution is also likely to influence for the aggregate marginal propensity to consume out of wealth. Richer households tend to have a lower marginal propensity to consume than poorer ones, so a very uneven distribution of wealth skewed towards households at the top end of the distribution is likely to lower the estimated elasticity, other things equal. In the case where wealth is entered in a disaggregated way, the different wealth elasticities will depend on the share of particular assets in the overall wealth holdings of the household sector and their fungibility: less liquid assets such as pension fund savings and housing wealth can be expected to have less of an effect on consumption.

Housing wealth

Based on equation (i), the estimated elasticity of consumption with respect to net housing wealth in Hong Kong is lower than in many other industrialised countries, as shown in table 5 below. This reflects a relatively low marginal propensity to consume out of housing wealth which is estimated to be 0.03 for Hong Kong compared with 0.10 in the US, and 0.08 in Canada. Nevertheless, a 10% increase in house prices is estimated to raise aggregate consumption by around 1%, similar to the effect in the US, UK and Canada reflecting the size of housing wealth relative to consumption.

Table 5: Consumption response to a permanent 10% increase in house prices

	Hong Kong (Equation 1 in table x)	US	UK	Canada	Australia
Sample period	1985-2000	1960-2000	1970-2000	1976-2000	1981-1999
Long run wealth elasticity (1)	0.072	0.136	0.092	0.407	0.219
Long run MPC out of wealth (1), (2)	0.03	0.10	0.04	0.08	0.05
Housing wealth to consumption (1998)	2.9 [3.7]	1.0	2.7	1.3	3.2
Estimated % increase in consumption from permanent 10% increase in house prices	0.9 [1.1]	1.0	1.1	1.1	1.6

(1) Estimated elasticity on housing wealth variable for Hong Kong, the US and the UK which is entered separately to financial wealth; for Canada and Australia, the estimated elasticity is on aggregate - housing and financial - wealth.

(2) Evaluated at average wealth to consumption ratio across whole sample period for Hong Kong; and period 1995-99 for other countries. Note, the estimated marginal propensity to consume for Hong Kong would be smaller, at 0.02, if evaluated at 1995-99 average.

Source: Estimates for Hong Kong are based on equation (i) in table 4 and from Bertaut (2002) for other countries.

The low marginal propensity to consume out of housing wealth in Hong Kong is consistent with an uneven distribution, skewed towards richer households. Though around two thirds of the total (public and privately built) housing stock is privately owned, the importance of the rented sector means that this wealth is narrowly held. According to a survey by the Housing Association conducted in 1999, 48.7% of all households lived in their own property, which is significantly lower than the proportion of the housing stock that is privately owned (Table 6) suggesting that the rental sector is large relative to other countries. In fact, the survey estimated that 32.5% of households lived in public rented accommodation and it can be inferred that the residual 16.6% lived in private rented accommodation[13]. The rate of owner occupation is lower than in other countries (e.g. the UK rate is 67% which is, in turn, lower than in the US), but consistent with the observation that land and property prices in Hong Kong are high relative to other economies making it difficult for first time buyers to enter the market.

Table 6: Ownership of residential dwellings

	C&SD estimates		Housing Association estimates	
	% of stock		% of stock	% of households owner-occupier
	2001	1999	1999	1999
Private	51.2	50.8	51.7	
Public subsidised sales	16.0	14.5	12.8	
Sub-total: private ownership including public sales	67.2	65.3	64.5	
Public rental	32.8	34.7	32.5	
Other (private and public temporary dwellings)			2.0	
All				48.9

Source: Census and Statistics Department; "Survey of Housing Aspirations of Households" conducted by the Housing Association (1999).

Using the above estimates, it is possible to calculate the impact on consumption from the fall in house prices since 1997. Between their peak in 1997 Q3 and 2002 Q2, average house prices fell by 58% and housing wealth fell by 52%. If sustained, that would reduce the level of annual 2001 consumption by around HKD 66 billion, or just under 9% of annual 2001 consumption. Note that this is similar to the actual fall in the level of annual consumption between 1997 and 2001 of 7.6%.

[13] For completion, note that the survey showed that 2% of households lived in temporary dwellings.

Financial wealth

The estimated elasticity of consumption with respect to financial wealth for Hong Kong is similar to that in the UK and France but lower than for the US and Japan. Recall, that this estimate is based on a measure of financial assets – comprising notes and coins, bank deposits and equities - for the private sector as a whole rather than household sector separately. We could, of course, assume such a distinction does not matter because corporate sector wealth is ultimately owned by households. Evaluating the elasticity using private sector financial assets would imply a marginal propensity to consume out of net financial wealth of 0.012 which is low compared with other industrialised countries.

It is perhaps extreme to assume that households see through the 'corporate veil' so an alternative approach is to calibrate a marginal propensity to consume on the assumption that the ratio of household sector financial wealth relative to consumption in Hong Kong is similar to that in other industrialised economies. This varies between 2.5 (Australia) and 5.2 (US) for the group of selected countries shown in table 7 based on estimates taken from Bertaut (2002). That would imply a marginal propensity to consume of between 0.016 and 0.034, which is similar to that for Canada, France, the UK and the US.

Table 7: Consumption response to a permanent 10% increase in financial wealth

	Hong Kong (Equation 1 in table x)	US	UK	Canada	Australia	Japan	France
	1985-2000	1960-2000	1970-2000	1976-2000	1981-1999	1976-2000	1981-1999
Long run financial wealth elasticity	0.085	0.230	0.088	0.139	0.219	0.285	0.101
Long run MPC out of financial wealth [(1)]	-	0.04	0.02 [(2)]	0.04	0.09	0.06	0.03
Financial wealth to consumption (1998)	-	5.2	4.8	3.8	2.5	4.6	3.4
% increase in consumption from 10% increase in financial wealth	-	2.1	1.0	1.5	2.3	2.8	1.0
Equity wealth to consumption (1998)	-	2.0	2.0	1.2	1.1	0.8	0.5
% increase in consumption from 10% increase in equity prices	-	0.8	0.4	0.5	1.0	0.5	0.2

(1) The wealth variables in the regressions are defined as follows: financial and non-financial wealth for Hong Kong, the US and the UK; equity and non-equity wealth for Canada; financial wealth only for Japan and France; and aggregate – housing and financial - wealth for Australia.

(2) The consumption function in the Bank Of England's main macro model has a similar elasticity of 0.11giving an implied marginal propensity to consume of 0.023.

Source: Estimates for Hong Kong are based on equation (i) in table 4, and are from Bertaut (2002) for other countries.

There is some limited information on household share ownership in Hong Kong from a 1999 survey by the Securities and Futures Commission, which found that 17% of households owned risky assets, predominantly equities. Assuming that these shares are directly held, this suggest ownership levels close to those in Canada, the UK and the US and higher than in European countries (though indirect ownership of shares through private pension funds is likely to be lower).[14] Together with a relatively high stock market capitalisation to GDP ratio that would tend to suggest a marginal propensity to consume out of financial wealth of between 0.02 (the UK) and 0.04 (Canada and the US).[15]

Table 8: Indicators of household sector equity wealth holdings

	% of households directly owning equities	% of households owning equities including pension and mutual funds	Stock market Capitalisation to GDP
Hong Kong 1999 Securities and Futures Survey of retail investors	17% (1)		309
US 1998 Survey of Consumer Finances	19%	49%	130
UK 1995 Family Expenditure Survey	24%	27%	153
Canada 1996 Family Expenditure Survey	21%	37%	90
France Paris Bourse (1997)	9%	13%	89
Germany 1996 soll und Haben Marketing Survey	5%	10%	59
Italy 1995 Survey of Household Income and Wealth	7%	13%	48

(1) % of private investors holding risky investment products - the majority of which are Hong Kong stocks as suggested by trading information: of the 20% of households who said they had traded in risky assets in past 3 years, 18% involved HK stocks.

Source: 1999 SFC Survey for Hong Kong and Bertaut (2002) for other countries

[14] The survey does not specify whether these equities are directly held or, alternatively, indirectly held through pension and other mutual funds, it seems likely that respondents would answer with respect to their direct holdings. There is no time series information available about indirect share ownership.

[15] The SFC survey also provides some limited information about the value of holdings across different bands. The HKMA estimate that the total value of share holdings by private investors is around HKD 100 billion (see Lai (1993), which is less than one tenth of the size of housing assets and just 2.7% of total Hang Seng market capitalisation which seems a bit low.

Robustness

Table 9 below shows the estimated elasticities and implied marginal propensity to consume out of labour income and wealth for various definitions of wealth. Equation 1 updates our preferred equation (i) to 2002 Q2. The elasticities on net housing and net financial wealth are now identical, but the implied marginal propensity to consume out of income and wealth are little changed. If housing wealth is defined gross instead of net of mortgage liabilities, as shown in equation 3, the elasticity rises a little but the implied marginal propensity to consume out of housing wealth is virtually unchanged.

When net financial wealth is dropped from the long run of the equation, the elasticity and implied marginal propensity to consume out of labour income rises markedly, from around 0.70 to close to 1. The elasticity on net housing wealth is, somewhat surprisingly, little changed. Similarly, it is little changed when average house prices rather than the HKMA estimates of net housing wealth are included, as shown in equation 4. Adding stock prices to this specification has little effect on either the coefficient on labour income and housing wealth (equation 6). However, the coefficient on stock prices is substantially lower than that on net financial wealth and is not significant at the 5% level. Given the reasonable levels of share ownership, the lack of significance may be due to the high volatility of stock prices over the period.

If housing wealth and financial wealth are entered in an aggregate way instead of separately, as in equation 7, the wealth elasticity more than doubles from 0.10 to 0.24 while the coefficient on labour income is little changed from our prefered equation. This could mean that the marginal propensity to consume is significantly higher than suggested by our estimates thus far, though it is worth recalling that the estimate of net financial wealth is defined across the private rather than household sector and so may not be appropriate.

In summary, in the disaggregated wealth equations, the long run coefficient on housing wealth seems robust to whether this is measured by the level of housing wealth or house prices, and whether or not financial wealth is included. The marginal propensity to consume out of housing wealth varies between 0.04 and 0.05. If housing wealth is aggregated with private sector financial wealth, the wealth elasticity rises markedly, but we have reservations about these estimates which are based on a level of financial wealth that is certainly too high because it includes corporate sector financial assets).

The coefficient on the level of the real interest rate also appears to be robust to different definitions of wealth, varying within a narrow range of 0.23 to 0.29 (not shown). The elasticity on labour income, on the other hand, appears to be rather sensitive to the way in which household wealth is measured, varying within a wider range of 0.61 to 0.99.

Table 9: Sensitivity of income and wealth coefficients

Sample period 1985 Q2 – 2002 Q2

Eq	Long run variables	Estimated elasticity	Implied marginal propensity to consume [(1)]	Adjusted R^2 of equation
1.	Labour income	0.482 **	0.719	0.60
	Net housing wealth	0.102 **	0.039	
	Net financial wealth	0.102 **		
2.	Labour income	0.450 **	0.672	0.60
	Gross housing wealth	0.125 **	0.040	
	Net financial wealth	0.090 **		
3.	Labour income	0.645 **	0.963	0.57
	Net housing wealth only	0.106 **	0.040	
4.	Labour income	0.664 **	0.991	0.56
	House prices only	0.144 **	0.046	
5.	Labour income	0.613 **	0.915	0.56
	Net housing wealth	0.096 **	0.037	
	Stock prices	0.032		
6.	Labour income	0.630 **	0.940	0.57
	House prices	0.132 **	0.042	
	Stock prices	0.032		
7.	Labour income	0.410 **	0.612	0.55
	Aggregate net housing and financial wealth	0.241 **		
	Net housing wealth		0.092	
	Net financial wealth			

** Significant at 5% level

[(1)] To calculate the implied mpc, the ratio of labour income to consumption is 0.67; the ratio of net housing wealth to annual consumption is 2.63 and, for gross housing wealth, is 3.15 over the sample period.

Stability

To check stability, we estimate our preferred specification across two sub-samples allowing for ten years worth of data in each sub-sample to ensure sensible estimates of the long run coefficients (Table 10). In the earlier sample period, labour income plays a more important role in explaining consumption than the long run wealth variables. Net financial wealth is not significant in either the long run or dynamics of the equation, and housing wealth is only significant at the 20% level. The long run coefficient on labour income falls markedly in the second sub-sample which likely reflects the downward drift in the consumption to labour income ratio after the Asian crisis noted earlier, but it still gives a plausible implied marginal propensity to consume of 0.63 bearing in mind that this covers a period of volatility in the macro economy.

Table 10: Sub-sample stability

Dependent variable: Quarterly change in log of real consumption

	1985 Q2-1995 Q2	1992 Q2-2002 Q2	1985 Q2-2002 Q2
Constant	1.26 (2.4)	2.40 (3.8)	1.78 (4.8)
Log change in labour income	0.30 (2.6)	0.45 (2.0)	0.29 (2.7)
Log change in net housing wealth	0.07 (1.7)	0.04 (0.9)	0.07 (2.7)
Log change in net financial wealth	0.02 (0.6)	0.07 (2.3)	0.06 (3.0)
Log change in unemployment rate	-0.03 (-2.4)	-0.03 (-2.0)	-0.03 (-2.6)
Log consumption (-1)	-0.59 (-4.2)	-0.58 (-3.8)	-0.53 (-4.8)
Log labour income (-1)	0.44 (4.2)	0.24 (2.7)	0.26 (3.9)
Log of net housing wealth (-1)	0.032 (1.4)	0.056 (2.9)	0.054 (3.7)
Log of net financial wealth (-1)	0.017 (0.6)	0.062 (2.4)	0.054 (2.6)
Real interest rate (-1)	-0.37 (-2.4)	-0.22 (-1.9)	-0.29 (-3.7)
Long run coefficients:			
Labour income	0.75	0.41	0.48
Housing wealth	0.053	0.10	0.10
Financial wealth	0.028	0.11	0.10
Sum of coefficients	0.83	0.62	0.68
Diagnostics:			
R-squared	0.60	0.75	0.65
S. E. Regression (x100)	1.2	1.1	1.2
Breusch-Godfrey LM(4), F-stat	0.61	0.55	0.73
ARCH LM(4), F-stat	0.55	0.47	0.80
Normality	0.92	0.32	0.42
Ramsey reset test, F-stat	0.04	0.65	0.74

IV Conclusions

This paper set out to estimate a consumption function for Hong Kong along standard Life Cycle-Permanent Income Hypothesis lines. This is not straightforward given the lack of official data on income and wealth. However, using proxies for labour income and housing and financial wealth we can uncover a stable relationship which gives plausible estimates of the long run marginal propensities to consume out of income and wealth.

The marginal to propensity to consume out of labour income is estimated to be 0.87 for Hong Kong, broadly in line with estimates for other industrial countries, e.g. the UK. There is some evidence that it has fallen during the 1990s, possibly reflecting the sequence of negative shocks to the Hong Kong economy, which include the Asian crisis in 1997-98 and the global economic downturn starting in 2000.

The implied marginal propensity to consume out of housing wealth is estimated to be 0.03, which is lower than estimates for other industrialised economies but consistent with a relatively uneven distribution of housing wealth in Hong Kong. Nevertheless, because of the sheer size of housing assets in Hong Kong, it is estimated that the 52% drop in housing wealth since 1997 may have reduced consumption by up to HKD 66 billion, or just under 9% of annual 2001 consumption. The actual fall in consumption between 1997 and 2001 was 7.6%.

For financial wealth, the implied marginal propensity to consume is estimated to lie between 0.02 and 0.04, similar to estimates for Canada, the UK and the US. These estimates are partly calibrated due to data limitations on households' holdings of financial assets in Hong Kong, and are perhaps less soundly based than the estimates relating to housing wealth.

Annex 1

Unit Root Tests

Augmented Dickey-Fuller Unit Root Test

Lag length: 2

All variables in logs, except for unemployment and interest rates, seasonally adjusted, and in real terms (unless stated otherwise) by deflating by consumers' expenditure deflator

Variable	Level	Log change
Consumers' spending	-2.32	-3.69 ***
Labour income (LY1)	-1.65	-3.77 ***
Labour income (LY2)	-1.61	-3.78 ***
Labour income (LY3)	-1.64	-4.48 ***
Short real interest rate (1 month HIBOR minus annual CPI inflation)	-1.08	-5.23 ***
Net housing wealth	-1.48	-3.90 ***
Net financial wealth	-1.75	-3.47 **
Unemployment rate	-0.82	-4.13 ***

MacKinnon critical values for unit root tests. *** and ** and *denote significant at 1% and 5% and 10% level.
All variables are in real terms, in logs (except for real interest rate and unemployment rate) and are seasonally adjusted using eviews Census X-12 method.

Annex 2

Data Definitions

Consumers' spending	Private consumption expenditure at constant 2000 prices (Census and Statistics Department)
Real labour income (LY1)	Nominal average payroll per person engaged (HKD) multiplied by employment (General Household Survey) deflated by consumers' expenditure deflator
Real labour income (LY2)	Nominal average payroll per person engaged (HKD) multiplied by number of persons engaged (Census and Statistics Department) deflated by consumers' expenditure deflator
Real labour income (LY3)	Compensation of employees (HKD, Census and Statistics Department)
Short real interest rate	1 month HIBOR minus annual Consumer Price Index inflation
Net housing wealth	HKMA estimates of gross private housing wealth less loans to purchase subsidised flats and other residential properties (Hong Kong Monetary Authority)
Net financial wealth	Notes and coins held by non-banks, deposits from customers and total stock market capitalisation less loans for credit card advances and for other private purposes (Hong Kong Monetary Authority)
Unemployment rate	Unemployment rate (%, Census and Statistics Department)

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